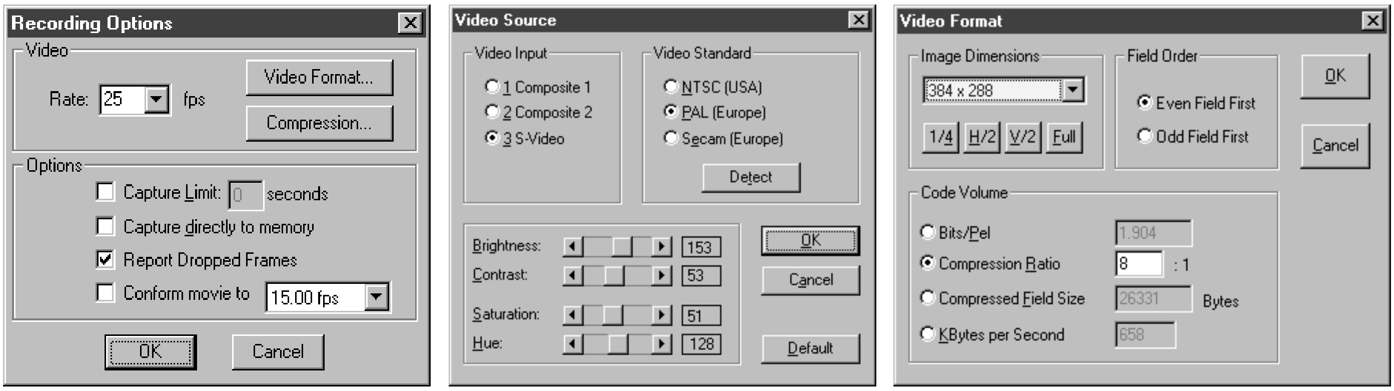
The basic principles of video processing with a PC were explained in the first part of this article. In this part, we look at how to go about editing a video clip using the PC, and we describe the features of inexpensive video editing systems. In this case we use the Adobe program Premiere 5.0 as an example. This widely-distributed program is often included with the video capture card. Even if you have a different program, this article will still be useful, since all video editing programs work in essentially the same way. You can thus easily adapt the descriptions here to your own program.

By Dr Martin Seiwert (Ecco Multimedia)

video processing on the PC (2)

part 2: using the video editor



Rate: 25 fps

☐ Capture Limit: 0 seconds

☐ Capture directly to memory

☑ Report Dropped Frames

☐ Conform movie to 15.00 fps

○ 1 Composite 1

○ 2 Composite 2

● 3 S-Video

○ NTSC (USA)

● PAL (Europe)

○ Secam (Europe)

Brightness: 153

Contrast: 53

Saturation: 51

Hue: 128

384 x 288

● Even Field First

○ Odd Field First

○ Bits/Pel 1.904

● Compression Ratio 8 : 1

○ Compressed Field Size 26331 Bytes

○ KBytes per Second 658

Figure 1. Setup menus for scanning in videos.

After all the scenes have been shot, it’s time to start with the editing. All scenes that are to be included in the final product must be scanned into the computer. This requires the outputs of the video recorder or camcorder to be connected to the inputs of the video capture card. You will also need a special video editing program, such as Adobe Premiere (which we take as an example for the following descriptions).

After starting the editing program, select ‘Record’ from the menu and then start the video recorder. You should then see the video imagery on the computer monitor and also on the control monitor (if present). If you do not, you have probably selected the incorrect input in the setup menu. The various possibilities are illustrated in **Figure 1**. Note that the actual contents of the screen menus depends on the particular video capture card used.

You can select the input in the Video Source menu, which also allows you to select the video standard. Most video capture boards can automatically detect the video format of the input signal. At the bottom of the Video Source menu you can see sliders for adjusting the brightness, contrast, colour saturation and hue. Before changing any of the default settings, make sure that your computer screen and/or control monitor are correctly adjusted. There is often a considerable difference between the appearance of the image on the computer screen and the control monitor (television set). Which should you choose? That depends on the intended use of the final product. If you plan to play it back to the video recorder for

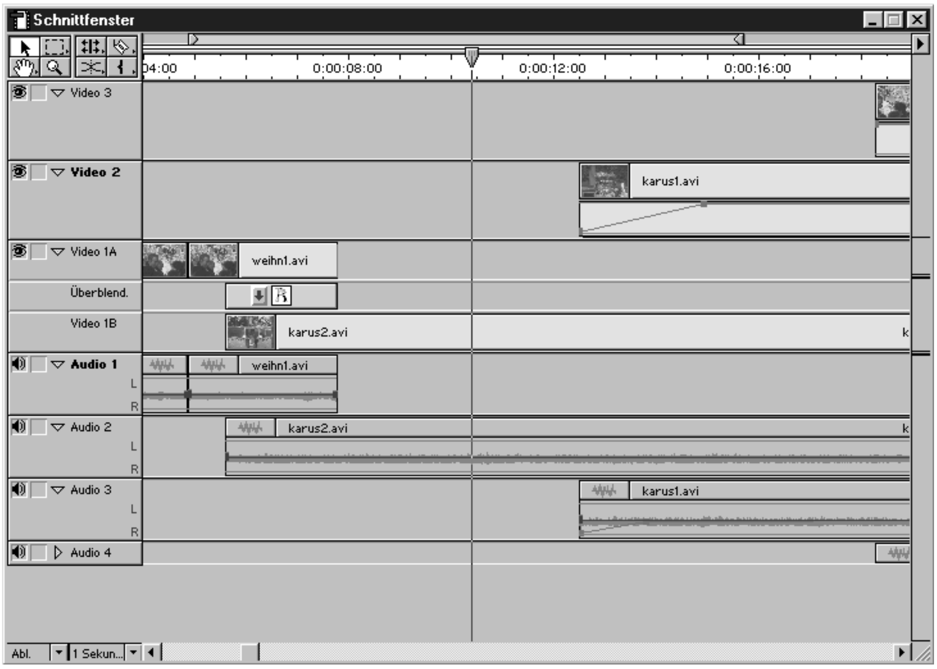


Figure 2. The editing window of the Premiere 5.0 program.

distribution via video cassettes, then you should go by the appearance of the image on the control monitor. If on the other hand you plan to use the video clip as a computer video or for a multimedia application, then the appearance of the image on the computer screen is what counts.

In the Recording Options window, you can select the recording format as well as the compression ratio or data rate. Here you should be guided by the requirements of your intended final product. For a computer video with (for example) 320 x 240 pixels, a ‘one-quarter’ resolution of 384 x 288 pixels is adequate. When selecting the compression ratio, you always have to make a compromise between the processing power of the PC and the picture quality. The higher the compression ratio, the more the quality of the imagery is degraded by compression artifacts, but increasing the compression ratio reduces the data rate and thus reduces the demands placed on the computer and the hard disk drive. The following are indications that the selected data rate is more than you system can handle:

1. On completion of the scan, the video editor reports one or more missing frames (‘dropped frames’).
2. The playback of the scanned-in video is jerky: the sound track is normal, but the video ‘freezes’ briefly.

Remarkably enough, I have noticed with two different computers that playback is more critical than scanning. Data rates that work without any problems for scanning repeatedly result in jerky playback. If you plan to re-record the end product on a video recorder, you have no choice but to reduce the data rate to a value that results in problem-free playback, since the video recorder will naturally record every hiccup in the playback video. For computer videos, this is not a problem, since they will not be played back at the real-time rate.

Finally, you have to set up the sound track. You have to decide whether you want to have a sound track, and if so then you have to select the quality level for recording the audio signal. The recording level can be set either via the audio section of the video capture card or a separate sound card, depending on the particular video capture card that you use. If you use the sound card, then you can use any suitable audio program, such as the Windows Audio Recorder.

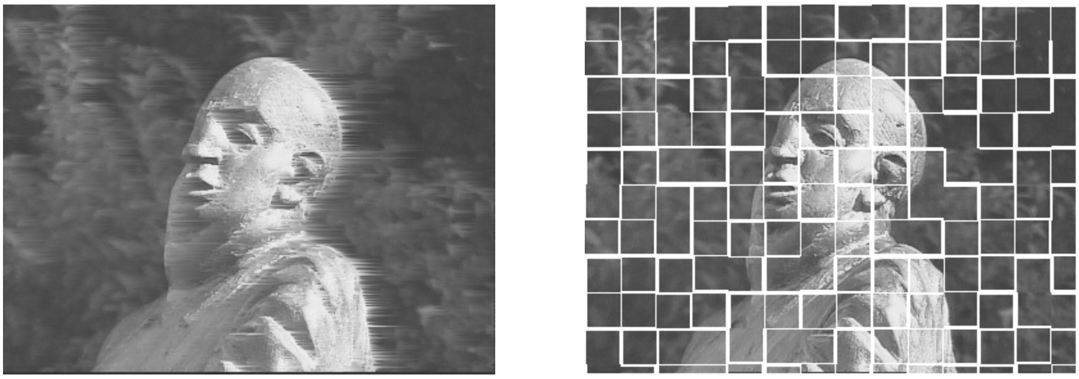
After all these selections have been made, the actual scanning process is refreshingly simple. Just start the video recorder and click on the Start button, and the video is scanned in. To stop scanning, click with the mouse or press the ESC key. A new window will be opened to display the scanned-in imagery, which can be checked and stored.

Editing

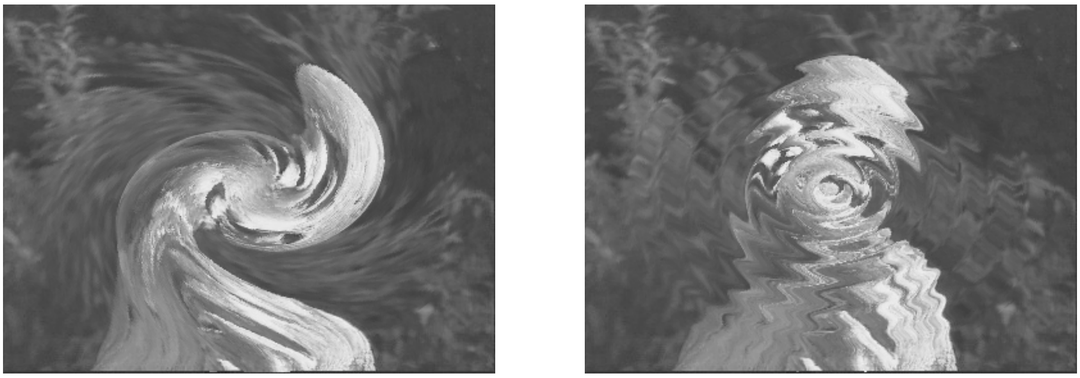
After all the scenes to be edited have been scanned in, you have to collect them together in the project window of the editing program. You can use the Import function for this, or drag and drop. The project window displays an overview of the collected scenes in the form of icons. You can select individual scenes and drag them into the editing window, arranging them according to your scenario. The editing window is constructed so that it largely mimics the traditional film editing technique with celluloid and scissors. You can ‘cut’ individual pieces of film with a knife, and you can use the mouse to arrange the pieces however you wish. ‘Hard’ cuts are thus made by simply pushing two pieces of film together in the editing window.

In addition to hard cuts, fade-overs are commonly used. For this purpose, the first video track is specially divided into the subtracks a and b. The film pieces for the fade-over are positioned on tracks 1a and 1b such that they overlap for the duration of the desired blend interval (see **Figure 2**). A large number of blend effects are available in the fade-over window, each illustrated by a small animation. All you have to do is to select the desired effect and drag it with the mouse to the editing window, dropping it in the overlap region between tracks 1a and 1b. In addition to the classical ‘soft blend’ and ‘additive blend’ effects, you can also choose from ‘wipes’ in various directions, as well as stripes and circular blends. There is also a series of attractive digital transitions, such as turning the page of a book, fade-overs

Original **Replication**



Wind effect **Tiled**



Vortex **Waves**

Figure 3. A few sample filters from the Premiere program. All filters can be made time-varying.

in small rectangles, 'whirlpool' and many more. If you have enough patience, you can even design your own transitions using the transition builder tool set.

To see how the fade-over looks, click on the time bar at the top of the editing window while pressing the ALT key. This causes the film to be displayed in the viewing window at the time corresponding to the location of the mouse pointer. By moving the mouse back and forth a bit, you can get an impression of how the transition works. You can judge it even better if you look at a preview. However, to do so you must first let Premiere calculate the effect over a selected time interval. The rendering time naturally is strongly dependent on the capabilities of the processor, the video capture card and the settings, but it will typically range between 10 to 60 times the length of the interval to be rendered. Once this is finished, you can view the transition in real time.

Filters

The term 'filter' is used collectively for all types of effects and processing that affect an individual piece of film. The classical filters are:

- ✓ brightness, contrast, saturation and hue correction;
- ✓ soft focus and edge enhancement;
- ✓ local contrast smoothing;
- ✓ black-and-white (monochrome) and
- ✓ mirror-image.

Other filters are familiar from photo-manipulation programs, such as:

- ✓ solarization;
- ✓ relief;
- ✓ lens distortion and lens reflection;
- ✓ ripple;
- ✓ crystallization and
- ✓ mosaic,

to mention only the most important ones. In contrast to photo manipulation, with the video editor these filters can be used in a timer-varying manner, which allows interesting effects to be produced. Gradually bringing a blurred image into focus, showing an artificial water surface with a variable amount of ripple, and simulating the focussing of the human eye with variable depth of field are only a few examples of the many possibilities.

In addition, there are also filters that are only applicable to video. These modify the time sequence of the individual frames. A simple example is reverse playback. One of these types of filters is the 'motion' filter, which allows the camera position to be changed (similar to an animation program). With this filter, you can add zoom and pan effects after the fact.

Transparency

Premiere allows up to 99 video tracks, and a time-variable degree of transparency can be individually set for each track. This effectively puts a complex video mixer at your disposition, with which you can create subtle fade-overs and effects using more than two pieces of film.

It is also possible to make certain parts of the image of a given film strip transparent, for example in order to present a speaker in front of an exotic background. For this purpose, the speaker is first filmed standing in front of a uniformly-coloured background. Traditionally, this background is blue, so this effect is called ‘blue screen’. However, any desired colour can be used. The selected colour can be defined in Premiere to be transparent, so that a film running in the background and displaying some imposing monument will be seen behind the speaker. The ‘alpha channel’, commonly used in photo-manipulation programs for making transparency masks, is also supported by Premiere.

Titles

Titles are generated in a special titling window, in the same way as in a vector drawing program. In addition to the fonts installed on the computer, you can use vector drawing elements such as straight lines, rectangles, circles and ellipses. Individual elements can be provided with shadows, and there is even a natural-appearing diffuse shadow effect with automatic alpha channel. Titles can be switched to transparent at the click of a button, so that they can be displayed in front of any desired background. Scrolling titles are also easily generated.

Limitations

The creative possibilities of affordable PC-based video editing software match the full scope of professional systems. You can give your imagination a free rein, and even very complicated effects can be realized (albeit not always directly).

The catch is the working speed. In order to properly assess a given effect, you have to view it in preview mode. This requires a certain amount of rendering time, which even for short scenes can easily amount to a couple of minutes. Of course, once a scene has been rendered it is saved, but only as long as no further changes are made within the working region. Unfortunately, fine tuning (such as adjusting the length of a fadeover) normally involves making a series of changes in a given region, requiring the scene to be rendered anew for each change. If you have to evaluate the results of editing a clip with a length of several minutes, the rendering time can easily be an hour or more.

Exporting the finished film

After the editing is complete, the film can be played back to a video tape. This is very simple: it works the same way as copying a tape from one recorder to a second one, except that here the PC takes over the role of the playback recorder.

However, if you want to use the finished film as a computer video, then the codec — the compression process — must be changed, as noted in the first part of this article. This is because the hardware of the video capture card in needed to play back the video in its standard form, and this hardware will naturally not be available to other users.

There is a whole series of codecs that can be used for this purpose. **Table 1** presents a summary of the available codecs, with their advantages and disadvantages. To change the codec, select the Export function in Adobe Premiere. You will see a series of selection windows, with which you can configure the many parameters of the video file to be generated. For a film clip of 5 minutes’ duration, the rendering time for converting the codec will be several hours.

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Table 1. Summary of standard codecs

Video, or Microsoft Video 1
File formats: MOV and AVI
Advantages: fast calculation with good reproduction quality.
Disadvantages: requires a high data rate; otherwise the image quality suffers significantly. Colour space limited to 16 bits.
Recommended for test videos and videos to be played back from the hard disk. As a rule, not suitable for playback from CD-ROM.

Cinepak
File formats: MOV and AVI
Advantages: On average, good data quality, even with data rates suitable for CD-ROMs. Comparatively good colour reproduction. Suitable for older-model computers as well.
Disadvantages: requires more calculation time than Video. Large uniform-coloured patches are sometimes a bit unstable.
Recommendation: well suited to reproduction from CD-ROMs, especially if they are to be played back on older-model computers.

Intel Indeo
File formats: MOV and AVI
Advantages: On average, good data quality, even with data rates suitable for CD-ROMs. Suitable for older-model computers as well. Gives very good results for subjects with relatively little motion (such as a speech or presentation).
Disadvantages: requires more calculation time than Video. Disturbing colour distortions are sometimes visible in scenes with fast motion.
Note: various versions are available. The current version is 5.0, but Windows 95 and 98 come with only version 3.2.

MPEG 1
File format: MPEG
Advantages: Excellent reproduction quality in comparison to other codecs. The imagery appears to have television quality, even at data rates as low as 170 kB/s.
Disadvantages: the decoding is relatively computation-intensive, so only a 166-MHz Pentium MMX (or better) can achieve full-resolution reproduction. With older-model computers (100 MHz Pentium and below), videos using Cinepak or Intel Indeo will work better. A MPEG decoder (player) is part of the standard Windows package only since Windows 95, but there is a MPEG player available for Windows 3.1. As a rule, MPEG encoders are not included in the standard software complement of a video capture card and must be acquired separately. You can find a good summary of MPEG and MPEG software at the Internet site www.mpeg.org.

RLE (Run Length Encoding)
File format: AVI
Advantages: lossfree compression, relatively fast encoding.
Disadvantages: limited to 8-bit colour.
Recommendation: the restriction of the colour depth to 8 bits is too severe for normal videos, besides which the data compression does not work all that well for normal videos. However, this codec is an outstanding choice for cartoons and animations, where the limited colour depth does not matter.